

Claims:

1. A method of treating water with activated sludge containing micro-organisms characterised in that said method comprises the steps of:
 - 5 - preparing an environmentally adapted biomass mixture by adapting said activated sludge to a quantity of water having given characteristics in a single reactor under first levels of aeration, whereby said environmentally adapted biomass mixture acquires the capacity to cause concurrent reactions for BOD removal, nitrification and de-nitrification; and
 - 10 - treating a portion of water having substantially the same given characteristics with said environmentally adapted biomass mixture capable of causing said concurrent reactions, in said single reactor under a second level of aeration not higher than said first levels of
 - 15 aeration.
2. A method of treating water according to claim 1, wherein said quantity of water having given characteristics is waste water.
- 20 3. The method of treating water according to claim 1 or 2, wherein said adapted-biomass preparing step comprises:
 - 25 - carrying out an initial adapting cycle treatment essentially consisting of: (a) a step of feeding said quantity of water into a solution of said activated sludge at a given inflow rate to prepare a suspension mixture; (b) an aeration step carried out under initial levels of aeration; (c) a sedimentation step for separating a supernatant portion

and a sediment portion; and (d) a step of withdrawing said supernatant portion at an outflow rate substantially equal to said inflow rate, said steps (a), (b), (c) and (d) being repeated until said activated sludge can cause a BOD-removal reaction and a nitrification reaction; and

- carrying out a subsequent adapting cycle treatment essentially consisting of the steps (a), (b), (c), and (d) defined above, except that said step (b) in said subsequent adapting cycle treatment is performed under subsequent levels of aeration lower than said initial levels of aeration, said steps (a), (b), (c) and (d) being repeated until said activated sludge can cause concurrent reactions for BOD removal, a nitrification and de-nitrification at a given pH value.

4. The method of treating water according to claim 3, wherein said water-treating step comprises:

- carrying out a concurrent-reaction cycle treatment essentially consisting of: (a') a step of feeding said portion of water into said environmentally adapted biomass mixture at a given inflow rate; (b') an aeration step carried out under said second level of aeration substantially equal to said subsequent levels of aeration, at a given pH value; (c') a sedimentation step for separating a supernatant portion and a sediment portion; and (d') a step of withdrawing said supernatant portion at an outflow rate substantially equal to said inflow rate.

5. The method of treating water according to claim 3 or 4, wherein said given pH value stands between 6 and 7.
6. The method of treating water according to claim 3 or 4, wherein said given pH value is about pH 6.8.
7. The method of treating water according to any one of claims 1 to 6, wherein said adapted-biomass preparing step or said water-treating step forms a unitary treatment cycle of about 6 to 8 hours.
8. The method of treating water according to claim 7, wherein said aeration step (b) or (b') lasts about 4 to 5 hours and comprises stirring said suspension mixture at an aeration rate of at least one volume equivalent per hour relative to the volume of said suspension mixture.
9. The method of treating water according to claim 7 or 8, wherein said feeding step (a) or (a'), as well as said withdrawing step (d) or (d'), respectively lasts about 30 minutes.
10. The method of treating water according to any one of claims 7 to 9, wherein the amount of said supernatant portion withdrawn in said withdrawing step (d) or (d') is in the range of from about 20 to about 30 % of the total volume of said suspension mixture.
11. The method of treating water according to any one of claims 7 to 10, wherein said sedimentation step (c) or (c') lasts about one hour.

12. The method of treating water according to any one of claims 3 to 11, wherein said solution of activated sludge in said adapted-biomass preparing step is prepared by feeding a portion of activated sludge into a clean water
5 contained in said reactor to yield a suspension mixture having a predetermined suspension ratio of from about 1,000 to about 3,000 mg/l.

13. The method of treating water according to any one of claims 3 to 11, wherein said solution of activated sludge in said adapted-biomass preparing
10 step is prepared by feeding a portion of activated sludge into a clean water contained in said reactor to yield a suspension mixture having a predetermined suspension ratio of from about 1,500 to about 2,500 mg/l.

14. The method of treating water according to any one of claims 3 to 13,
15 wherein said method further comprises, subsequent to said withdrawing step (d) or (d'), the step of decreasing the aeration rate applied in said aeration step (b) or (b'), when said pH is below said given value.

15. The method of treating water according to any one of claims 3 to 13,
20 wherein said method further comprises, subsequent to said withdrawing step (d) or (d'), the step of increasing the aeration rate applied in said aeration step (b) or (b'), when said pH is above said given value.

16. The method of treating water according to claim 14 or 15, wherein said
25 decreasing or increasing step comprises using a frequency converter and

modifying the revolution of said aerating device by decreasing or increasing frequencies.

17. The method of treating water according to claim 16, wherein said
5 frequencies for modifying the revolution of said aerating device are kept at about 20 Hz at the minimum.

18. The method of treating water according to any one of claims 3 to 17,
wherein said sedimentation step (c) or (c') comprises measuring dissolved
10 oxygen concentrations, and extracting part of said sediment portion from said reactor, when said measured concentrations indicates that oxygen saturation ratio is below about 25 %.

19. The method of treating water according to any one of claims 3 to 18,
15 wherein the temperature of said suspension mixture is kept between about 10 °C and about 20 °C by extracting part of said sediment portion from said reactor.

20. A system for treating water with activated sludge containing micro-
20 organisms, characterized in that said system comprises:

- a single reactor;
- means for preparing an environmentally adapted biomass mixture by adapting said activated sludge to a quantity of water having given characteristics in a single reactor under first levels of aeration,
25 whereby said environmentally adapted biomass mixture acquires the capacity to cause concurrent reactions for BOD removal, nitrification and de-nitrification; and

- means for treating a portion of water having substantially the same given characteristics with said environmentally adapted biomass mixture capable of causing said concurrent reactions, in said single reactor under a second level of aeration not higher than said first levels of aeration.

said system adapted for performing the method according to any one of claims 1 to 19.

21. The system for treating water according to claim 20, wherein said means for preparing an environmentally adapted biomass mixture comprises an apparatus for carrying out:

- an initial adapting cycle treatment essentially consisting of: (a) a step of feeding said quantity of water into a solution of said activated sludge at a given inflow rate to prepare a suspension mixture; (b) an aeration step carried out under initial levels of aeration; (c) a sedimentation step for separating a supernatant portion and a sediment portion; and (d) a step of withdrawing said supernatant portion at an outflow rate substantially equal to said inflow rate, said steps (a), (b), (c) and (d) being repeated until said activated sludge can cause a BOD-removal reaction and a nitrification reaction; and

- a subsequent adapting cycle treatment essentially consisting of the steps (a), (b), (c), and (d) defined above, except that said step (b) in said subsequent adapting cycle treatment is performed under subsequent levels of aeration lower than said initial levels of aeration, said steps (a), (b), (c) and (d) being repeated until said activated sludge can cause concurrent

reactions for BOD removal, a nitrification and de-nitrification at a given pH value.

22. The system for treating water according to claim 21, wherein said
5 means for treating a portion of water comprises an apparatus for carrying
out a concurrent-reaction cycle treatment essentially consisting of: (a') a
step of feeding said portion of water into said environmentally adapted
biomass mixture at a given inflow rate; (b') an aeration step carried out
under said second level of aeration substantially equal to said subsequent
10 levels of aeration, at a given pH value; (c') a sedimentation step for
separating a supernatant portion and a sediment portion; and (d') a step of
withdrawing said supernatant portion at an outflow rate substantially equal
to said inflow rate.
- 15 23. An installation for treating water comprising a system according to any
one of claims 20 to 22.